

8th Triennial International Aircraft Fire and Cabin Safety Research Conference
October 24 – October 27, 2016
Atlantic City, NJ

Author:

Richard DeWeese
Civil Aerospace Medical Institute
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125-0082
Phone 405-954-7529
Fax 405-954-4984
Rick.Deweese@faa.gov

David Moorcroft
Civil Aerospace Medical Institute
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125-0082
Phone 405-954-5513
Fax 405-954-4984
david.moorcroft@faa.gov

Amanda Taylor
Civil Aerospace Medical Institute
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125-0082
Phone 405-954-0248
Fax 405-954-4984
Amanda.M.Taylor@faa.gov

Topic:

Crash Dynamics – Seat Cushion Testing

Title: Evaluation of a Rigid Seat Test Methodology for Replacement of Seat Cushions on Transport Category Aircraft

Abstract:

The Federal Aviation Administration (FAA) has standards and regulations in place to protect occupants in the event of a crash. Dynamic testing is required by these standards in order to substantiate the safety of seating systems. In a vertical impact, the seat bottom cushion plays a vital role in controlling the load transferred to the occupant's spine. When the seat cushion needs to be replaced, the original foam is not always available. In that case, the current approach to substantiate the performance of a new multi-layer cushion construction is to repeat the full scale dynamic test with the seat and new cushion. Since that approach can be very costly, there is interest within the aircraft seating industry to have a simplified means of showing compliance. One proposed methodology is to compare the replacement cushion with the original cushion on a rigid seat, similar to the existing restraint replacement methodology. This proposed methodology was evaluated by the FAA Civil Aerospace Medical Institute via a series

of sled tests using real and rigid seats and a variety of typical aircraft foams. An evaluation of the lumbar load variability in repeated tests was necessary to properly interpret data gathered during this project.

Large variations in test results were observed and attributed to lack of reproducibility between Anthropomorphic Test Devices (ATD), ATD degradation, test setup variation, and foam variability. While consistent occupant initial position can lessen some variation, it does not completely eliminate it. The test results are sensitive to setup issues such as insufficient cushion preload, ATD arm interaction with the seat armrests, and inclusion/exclusion of a cushion cover. In light of these issues, careful attention to test setup and conducting repeated tests may be necessary to consistently assess the vertical impact performance of seat cushions installed on dynamically qualified seats. These results highlight the need for a standardized vertical calibration for the ATD, which will likely only be achievable if there are tight manufacturing tolerances on the pelvis, similar to the requirements for the Hybrid III pelvis. Overall, the variability observed in this project obscured the differences between tested cushions, and therefore the data was insufficient to demonstrate the validity of the replacement methodology.